

Remarks/Arguments

The Examiner rejected claims 1-28 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,699,596 (Yano) in view of U.S. Patent 6,509,689 (Kim). The Applicants respectfully disagree with the Examiner.

Claim 1 has been amended to more clearly indicate that the fluoride containing layer is in direct contact with the phosphor thin film layer. Support for this amendment may be found throughout the specification, but particularly, e.g., on page 4, third full paragraph.

The Examiner states that Yano discloses a barium thioaluminate or magnesium barium thioaluminate phosphor film with europium added as the activator. The Examiner acknowledges that Yano does not disclose a fluoride-containing layer directly adjacent to the blue phosphor thin film layer. The Examiner relies on Kim only for teaching the use of a second dielectric layer of magnesium fluoride on the bottom of the phosphor layer in a plasma display panel.

The presently claimed invention is an improved phosphor structure whereby a fluoride containing layer is provided directly adjacent the top and/or bottom of a blue light emitting phosphor thin film layer. Such a fluoride containing layer allows for the reduction of the annealing temperature required for annealing of the phosphor onto the glass or glass ceramic substrate with little decrease in phosphor luminance. The fluoride layer also lowers the formation or crystallization temperature of the phosphor film. It also acts to provide an interface between the phosphor film and adjacent dielectric layers otherwise in contact with the phosphor film to optimize the injection of electrons into the phosphor film to improve the overall electrical to optical energy conversion efficiency of the phosphor film.

As the Examiner stated, Yano is silent with respect to the provision of any fluoride containing layer adjacent the phosphor film. Kim is directed to a completely different type of display technology, notably a plasma display panel which has two substrates containing first and second electrodes as well as first and second dielectric layers. While the second dielectric layer is stated in claim

21 to be magnesium fluoride, in none of the taught embodiments in the specification is this layer directly adjacent and in contact with the entire of the top and/or bottom of the phosphor layer. Furthermore, claim 21 to which the Examiner refers depends from claim 18 where it is stated that there is a discharge chamber between the first and second substrates defined by barrier ribs connecting the first and second substrates, so again the second dielectric layer formed of magnesium fluoride is not provided directly adjacent a phosphor layer. In the plasma display panel there is a plasma discharge space between the first and second substrates in order that an electrode be exposed to the discharge chamber. The second dielectric layer is for the purpose of protecting the first dielectric layer from erosion by ion bombardments.

In contrast, in the presently claimed invention the fluoride containing layer is provided directly adjacent the phosphor thin film layer such that the annealing temperature required for annealing of the phosphor onto the glass or glass ceramic substrate is substantially lowered without affecting the phosphor luminance. The fluoride layer also lowers the formation or crystallization temperature of the phosphor film and acts to provide an interface between the phosphor film and adjacent dielectric layers otherwise in contact with the phosphor film to optimize the injection of electrons into the phosphor film to improve the overall electrical to optical energy conversion efficiency of the phosphor film. The fluorine as a fluxing agent thus lowers the crystallization temperature of the thioaluminate phosphor layer so that a display having this phosphor layer can be constructed on a glass substrate having a relatively low melting temperature. Thus, the fluoride containing layer is provided for a completely different purpose to that of Kim and in direct contact with the phosphor layer.

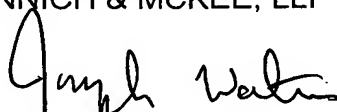
Thus, even assuming the propriety of combining Yano with Kim, the proposed combination of the cited references does not provide each and every element of the claimed invention. Yano merely provides a blue light emitting phosphor and is silent with respect to any type of fluoride containing layer. Kim provides a second dielectric layer which may be magnesium fluoride, but it is not directly adjacent and in contact with the phosphor layer. Furthermore, the Kim

technology is directed to plasma technology and as such the second dielectric layer functions differently to that of the claimed fluoride/phosphor film. Kim does not teach or suggest providing a magnesium fluoride layer directly adjacent the phosphor film, nor does Kim teach or suggest providing a magnesium fluoride layer directly adjacent and in contact with a blue light-emitting phosphor film in order to reduce the annealing temperature and not adversely affect the phosphor luminance. Kim in no teaches the advantages of the present invention since Kim does not teach or suggest the use of a thioaluminate phosphor.

The usefulness of fluxing agents to lower the crystallization temperature of a phosphor film is specific to the chemical compounds being used for the phosphor film. The use of the separate fluoride layer as protection from 'ion bombardment' as taught by Kim is not a requirement for an electroluminescent display, as suggested by the Examiner. Therefore one of skill in the art would not be led to the presently claimed invention as one seeking to provide a fluoride containing layer directly adjacent a phosphor to lower annealing temperatures would not be led to Kim's teachings of a plasma display where a second dielectric layer is not in contact with a phosphor, there is no teaching of any reduction in annealing temperature, and the second dielectric layer is for the purpose of stabilizing the first dielectric layer.

In view of the foregoing, the Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully Submitted,
FAY, SHARPE, FAGAN,
MINNICH & MCKEE, LLP



Joseph E. Waters, Registration No. 50,427
Customer No. 027885
1100 Superior Avenue, 7th Floor
Cleveland, Ohio 44114
(216) 861-5582